

rejections set forth in the Office Action dated March 14, 2002 in view of the following remarks.

Applicants thank the Examiner for the courtesy extended during the telephonic interview with Applicants' representative on May 29, 2002. During that interview, the Information Disclosure Statement and rejections under 35 U.S.C. § 102 were discussed.

Rejections Under 35 U.S.C. § 112

Claim 14 was rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Claim 14 has been amended to clarify any indefiniteness. Accordingly, Applicants submit that all claims are now sufficiently clear and definite, and respectfully request withdrawal of the rejections under 35 U.S.C. § 112, second paragraph.

Information Disclosure Statement

The Examiner has not considered references included in the Information Disclosure Statement filed on August 8, 2001 due to the large number of references cited in that Information Disclosure Statement. The Applicants have worked in this area of technology for many years and are aware of many references. The large number of references cited in the Information Disclosure Statement filed on August 8, 2001 is a reflection of this. Applicants believe that all the cited references are potentially relevant. Applicants filed the Information Disclosure Statement in good faith, without attempt to "hide" any particular reference.

In the telephonic interview on May 29, 2002 with Applicants' representative, the Examiner requested that the Applicants designate 40 references from the Information Disclosure Statement filed on August 8, 2001 to assist the Examiner with consideration of that Information Disclosure Statement. To comply with this request, Applicants have submitted a copy of the Information Disclosure Statement filed on August 8, 2001 with 40 references designated by checkmarks. However, this is not a representation that the other references are not important or material to the claims of the present invention. Applicants respectfully request that the Examiner consider and initial all references filed on August 8, 2001.

Rejections Under 35 U.S.C. § 102(b) and § 103(a)

Claims 1-32 are rejected under 35 U.S.C. §102(b), or in the alternative for claim 30 under 35 U.S.C. §103(a), as being unpatentable over U.S. Patent No. 4,440,194 to Beurrier ("Beurrier"). Applicants respectfully disagree.

As mentioned on page 2 of the Specification of the present invention, irradiated polyvinylidene fluoride (PVDF) is reported to have a strain of up to 4 percent when converting from electrical to mechanical energy. Similar to the piezoelectric ceramics, PVDF is often not suitable for applications requiring strains greater than 4 percent. To compensate for the poor mechanical output of PVDF polymers, Beurrier focuses his invention on a device that provides improved mechanical output for a dual PVDF system.

Thus, Beurrier describes an actuator that increases the mechanical output of two separate piezoelectric actuators. The two piezoelectric actuators are aligned and oppositely poled such that when electrically stimulated, the device effectively increases linear or rotation displacement relative to a single piezoelectric actuator.

While Beurrier describes such a device to improve mechanical output for a dual PVDF system, he does not teach or remotely suggest the claimed invention. Claims 1-32 all recite a transducer comprising a single electroactive polymer having multiple active areas. In general, Beurrier does not teach or remotely suggest a single electroactive polymer having multiple active areas. In contrast, the device of Beurrier comprises two PVDF polymers 6 and 7 (Fig. 1 of Beurrier) attached to upper and lower surfaces, respectively, of a paddle 5 and connector 10. These are clearly separate polymers, and not active areas on a single polymer as recited in the claims.

Independent claims 1, 10, 15, 28 and 32 each recite a transducer comprising a single electroactive polymer having multiple active areas, and are patentably distinct from Beurrier for at least these reasons:

Claims 2-9, 11-14, 16-27 and 29-31 each depend either directly from independent claims 1, 10, 15, 28 and 32, respectively, and are therefore respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to the independent claims. Further, the dependent claims recite additional elements which when taken in the context of the claimed invention further patentably distinguish the art of record.

For example, dependent claim 4 recites "wherein the at least two first active area electrodes and the at least two second active area electrodes are arranged radially around a central point". It is respectfully submitted that Beurrier does not teach such a limitation.

For at least these reasons, withdrawal of the rejections under 35 U.S.C. § 102(b) and under 35 U.S.C. § 103(a) are respectfully requested.

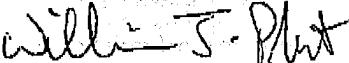
Applicants also note that claims 33-36 were not indicated as pending in the application, or indicated as allowable, rejected, objected to. Status of these claims is respectfully requested in the following Office Action.

Irrespective of the rejections Under 35 U.S.C. § 112, the Information Disclosure Statement, and the rejections Under 35 U.S.C. § 102(b), Applicants have amended 1, 8, 10, 11, 15, and 33 to clarify the present invention.

Conclusion

In view of the foregoing, Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the number set out below. If any fees are due in connection with the filing of this paper, the Commissioner is authorized to charge such fees to Deposit Account 50-0388 (Order No. SRIIP028).

Respectfully submitted,
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USSN 09/779,203
SRIIP028/4431-2

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Once Amended) A transducer for converting between electrical energy and mechanical energy, the transducer comprising an electroactive polymer having a plurality of active areas, the plurality of active areas comprising:

a first active area having at least two first active area electrodes and a first portion of the electroactive polymer arranged in a manner which causes the first portion to deflect in response to a change in electric field provided by the at least two first active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the first portion; and

a second active area having at least two second active area electrodes and a second portion of the electroactive polymer arranged in a manner which causes the second portion to deflect in response to a change in electric field provided by the at least two second active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the second portion,

wherein the electroactive polymer is elastically pre-strained.

8. (Once Amended) The transducer of claim 1 wherein the [polymer is elastically pre-strained] prestrain is anisotropic.

10. (Once Amended) A device for converting between electrical energy and mechanical energy, the device comprising:

an electroactive polymer having a plurality of active areas, the plurality of active areas comprising:

a first active area having at least two first active area electrodes and a first portion of the electroactive polymer arranged in a manner which causes the first portion to deflect in response to a change in electric field provided by the at least two first active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the first portion,

a second active area having at least two second active area electrodes and a second portion of the electroactive polymer arranged in a manner which causes the second portion to deflect in response to a change in electric field provided by the at least two second active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the second portion; and

a substantially rigid member coupled to a third portion of the electroactive polymer,

wherein the electroactive polymer is elastically pre-strained.

11. (Once Amended) The device of claim 10 wherein the [polymer is elastically pre-strained] prestrain is anisotropic.

14. (Once Amended) The device of claim 13 wherein the length of an attachment between the substantially rigid member and the polymer in a direction perpendicular to a desired motion of the first active area is greater than 50% of [the planar] a linear dimension of the first active area perpendicular to the desired motion of the first active area.

15. (Once Amended) A method for using an electroactive polymer comprising a first active area and a second active area, the first active area having at least two first active area electrodes and a first portion of the electroactive polymer, the second active area having at least two second active area electrodes and a second portion of the electroactive polymer, the method comprising:

prestraining the electroactive polymer;

providing a change in electric field to the at least two first active area electrodes; and

providing a change in electric field to the at least two second active area electrodes.

Please CANCEL Independent claim 32.

33. A device for converting between electrical energy and mechanical energy, the device comprising:

an elastically restrained electroactive polymer having a plurality of active areas, the plurality of active areas comprising:

a first active area having at least two first active area electrodes and a first portion of the electroactive polymer arranged in a manner which causes the first portion to deflect in response to a change in electric field provided by the at least two first active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the first portion,

a second active area having at least two second active area electrodes and a second portion of the electroactive polymer arranged in a manner which causes the second portion to deflect in response to a change in electric field provided by the at least two second active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the second portion;

a substantially rigid member having a first segment and a second segment, the first segment coupled to a third portion of the electroactive polymer, the second segment capable of motion assisted by deflection of the first portion of the polymer and/or capable of motion that causes a change in electric field in the first portion of the polymer; and

a frame coupled to a fourth portion of the polymer.

Please ADD Independent claim 37.

37. (Once Amended) A method for using an electroactive polymer comprising a first active area and a second active area, the first active area having at least two first active area electrodes and a first portion of the electroactive polymer, the second active area having at least two second active area electrodes and a second portion of the electroactive polymer, the method comprising:

providing a change in electric field to the at least two first active area electrodes;

providing a change in electric field to the at least two second active area electrodes; and

mechanically deflecting the first portion after the change in electric field has been provided, wherein the mechanical deflection after the change in electric field has been provided increases the electrical field between the at least two first active area electrodes.